Environmental Health Perspectives
Vol 90, pp. 67, 1991

Commentary

Concluding Remarks on Session I

by Michael C. Mix*

The papers presented during the first session have provided a useful introduction and a review of several important points that have been established during the past decade. Many carefully studied near shore marine environments and freshwater lakes are polluted with chemicals as indicated primarily by measurements of certain organics and metals in sediments. Fish and shellfish, including bivalve mollusks (clams, mussels, oysters) and crustacean (crabs and shrimp) used as food resources by humans inhabit contaminated aquatic environments. Fish and shellfish, especially bivalve mollusks, concentrate many undesirable organics and metals in their tissues. Fish and shellfish suffer from cancerous diseases. For finfish especially, there are correlations between the occurrence and/or prevalences of cancerous diseases and the degree of chemical contamination in the environment they inhabit. Meyers (*1*), Wolke (2), and Black (*3*) all described such a relationship for fish and the aquatic systems they have studied. For bivalve mollusks, the connection between cancerous diseases and chemical contaminants is much less convincing (*4*). There has been little solid evidence of a link between the two in studies conducted to date. Farley's studies on the sarcomas of softshell clams (*Mya arenaria*) from Maryland do not suggest a possible chemical causation (*5*). However, Gardner's interesting studies indicate that the germinomas of *M. arenaria* from contaminated areas he has studied appear to be associated with certain chemicals in the environment (*6*).

In addressing the central question to be considered during this conference (is there an increased risk due to the consumption of aquatic foods with measurable levels of contaminants?), the following general points and questions, related to the preceding papers, seem pertinent.

Which chemicals, or classes of chemicals, are important relative to risk assessments for aquatic resources? How can this be determined? For various reasons, there has been a considerable emphasis on polycyclic aromatic hydrocarbons (PAH) in many studies conducted to date. However, given the uncertainties about oral PAH exposures causing tumors in humans (*7*) and the rapid metabolism of PAH by fish, it may be more worthwhile to concentrate on other chemicals in the environment.

Which compounds bioaccumulate in fish or shellfish? Which compounds bioaccumulate in edible tissues of these organisms? To what extent are they passed on to mammals if consumed? Which aquatic species are important food sources? Several species of fish mentioned during this session would not appear to be particularly important in assessing risk (e.g., carp, brown bullheads) while others are, at least in certain geographical areas (e.g., winter flounder, softshell clams).

Because of their propensity for concentrating xenobiotics and their inability to quickly metabolize organics, consumption of shellfish may pose a more significant risk than fish. Are measurement of chemicals in raw flesh of value in risk analysis? What are the effects of cooking or other methods of preparation on compounds of interest? Is there an increase or decrease in the potential hazard?

Tissue composition may be important in considering risk assessment, given that organics tend to concentrate in lipids. Thus, salmonids with their lipid-rich flesh may be more likely to concentrate xenobiotics than flatfish, such as the English sole, which have relatively little lipid material in their flesh. Geographical locations may also be relevant. For example, west coast salmon generally spend their adult lives in the unpolluted Alaskan gyre. When they return to areas near their natal stream where they can be captured, they are not contaminated. In contrast, Great Lakes salmon may become contaminated because they spend their entire lives in waters polluted with chemicals. What is actually known about the efficiency of food chain transfers from aquatic species to man?

There are, of course, many other questions or issues that could be raised. It is a formidable task indeed to try to describe the hazards of exposures to xenobiotics through food chains/webs. This challenge is, of course, the focus of the conference, and many of these questions will be explored in the sessions that follow.

*Department of General Science, Oregon State University, Corvallis, OR 97331-6505.

REFERENCES

1. Myers, M. S., Landahl, J. T., Krahn, M. M., and McCain, B. B. Relationships between hepatic neoplasms and related lesions and exposure to toxic chemicals in marine fish from the U. S. West Coast. Environ. Health Perspect. 90: 7-15 (1991).
2. Murchelano, R. A., and Wolke, R. E. Neoplasms and nonneoplastic liver lesions in winter flounder, *Pseudopleuronectes americanus*, from Boston Harbor, Massachusetts. Environ. Health Perspect. 90: 17-26 (1991).
3. Black, J. J., and Bauman, P. C. Carcinogens and cancers in freshwater fishes. Environ. Health Perspect. 90: 27-33 (1991).
4. Mix, M. C. Cancerous diseases in aquatic animals and their association with environmental pollutants: a critical literature review. Mar. Environ. Res. 20: 1-141 (1986).
5. Farley, A., Plutschak, D. L., and Scott, R. F. Epizootiology and distribution of transmissable sarcoma in Maryland soft-shell clams, *Mya arenaria*, 1984-1988. Environ. Health Perspect. 90: 35-41 (1991).
6. Gardner, G. R., Yevich, P. P., Hurst, J., Thayer, P., Benyi, S., Harshbarger, J. C., and Pruell, R. J. Germinomas and teratoid siphon anomalies in soft-shell clams, *Mya arenaria*, environmentally exposed to herbicides. Environ. Health Perspect. 90: 43-51 (1991).
7. Kramers, P. G. N., and Van der Heijden, C. A. Polycyclic aromatic hydrocarbons (PAH): carcinogenicity data and risk extrapolations. Toxicol. Environ. Chem. 16: 341-351 (1988).